

1 **HANDS-FREE DOOR OPENER AND METHOD**

2

3 **Field of the Invention**

4 The subject invention pertains to an apparatus for
5 automatically opening a door and for more
6 specifically for the hands-free opening of a
7 restroom door.

8

9 **Background of the Invention**

10

11 Bathroom door handles can be a hot bed for germs
12 due to the poor hygiene practices of others. In
13 an effort to avoid contact with the door handle,
14 restroom patrons will often utilize any means
15 available to open a restroom door and exist common
16 necessary to avoid contact with the door handle.
17 Quite often people use their feet to pry the door
18 open, a paper towel to insulate their hands from
19 the door handle, grasp the door in a location
20 other than the handle, or even wait for another
21 patron to enter, in an effort to avoid contact
22 with the door altogether.

23

24 Automatic door openers are well-known in the art.
25 They are generally operated by motion detectors
26 and have bidirectional motors that both open and
27 close the doors as a patron approaches the door.
28 Essentially, the patron enters a zone in which a
29 proximity detector detects the presence of the

1 patron and automatically opens the door. There
2 are certain drawbacks of these automatic door
3 openers especially in the close quarters of a
4 public restroom. For example, due to the small
5 size of many public restrooms, proximity detectors
6 can activate from almost any movement in the
7 restroom. This results in the constant opening
8 and closing of the restroom door due to the
9 movement of the patron inside the restroom. In
10 addition, patrons entering the restroom from the
11 outside will often trigger the door to swing
12 inward where another patron may be standing.

13

14 Attempts to remedy these drawbacks have been made
15 by way of motors or opening mechanisms which stop
16 progress when obstructed. While these
17 improvements resolve a portion of the problems in
18 that the patron in the path of the door is not
19 injured, it is still inconvenient for all
20 involved. Keeping convenience in mind, it is
21 desirable to have a restroom door that can be
22 opened both manually or automatically upon the
23 affirmative action of a patron on the inside of
24 the restroom. This allows the patron on the
25 inside of the restroom to have a choice of
26 automatically or manually opening the restroom
27 door, as well as making the patron aware of the
28 doors automatic opening so that any impedance
29 thereof may be avoided.

Brief Summary of the Invention

Accordingly, it is an object to the present invention to provide an automatic restroom door opener initiated upon the affirmative action or command of a restroom patron. The automatic door opener comprises an actuator; a control unit and a power assisted drive mechanism. The drive mechanism comprises a limit unit which is in communication with a conventional door closer which allows the door to be opened manually from the inside or outside or automatically from the inside upon the affirmative action of a restroom patron. The affirmative action of the restroom patron required to open the automatic door, for example, can comprise a hand waving or oral command wherein the patron is provided instruction through iconic symbols triggered by the proximity of the patron to the actuator.

The actuator can be mounted in any area near the restroom door. For example, between the sink and door at a height sufficient to accommodate nearly any restroom patron. The actuator comprises at least one proximity sensor for detecting the proximity of a patron within at least one specific proximity zone. Each proximity zone corresponds to a specific distance from the activator.

1 For example, the proximity detector detects the
2 presence of a patron in a first zone. The
3 actuator then provides an iconic instruction
4 and/or an audible signal to instruct the patron to
5 wave hi or her hand close to the actuator. When
6 the patron's hand is waved in front of the
7 actuator, it enters a second proximity zone. The
8 proximity sensor, or a second proximity sensor,
9 then detects the proximity of the patron's hand to
10 the actuator, provides an audible signal of
11 detection and begins the door-opening process. At
12 any time the door may be opened manually from
13 inside or out.

14
15 The actuator alerts to the patron in each of the
16 various zones and provides a corresponding iconic
17 symbol on the face of the interface will light
18 thereby instructing the patron on the process for
19 opening the door. For example, as patron
20 approaches the restroom door to exit the restroom,
21 the proximity detector detects the presence of the
22 patron as the patron enters a first proximity
23 zone. Detecting the presence of the patron I the
24 actuator flashes a first signal which alerts the
25 patron I to the presence of the actuator and
26 provides a "wave hand" iconic symbol instructing
27 the patron I to wave his or her hand in front of
28 the actuator. As the patron approaches the
29 actuator and waves his or her hand in front of it,

1 the patron's hand enters a second proximity zone
2 and the actuator can illuminate a second iconic
3 symbol or color which alerts the patron to the
4 automatic opening of the door.

5

6 For example, the first and second proximity zones
7 can be variably set to meet the needs of the
8 specific restroom installation. The affirmative
9 action for example can be a movement such as a
10 hand wave or oral command in front of the actuator
11 which then initiates the opening of the door.
12 Upon completion of the affirmative action of the
13 patron, a second audible signal can be provided
14 alerting the patron to the opening of the door.
15 This informs the patron that the inward swinging
16 door will be opening immediately.

17

18 When initiated, the control unit sends a signal to
19 the power-assisted drive mechanism attached to a
20 conventional door closer. The conventional door
21 closer can be a preexisting door closer or a door
22 closing apparatus integrated into the system.
23 Conventional door closers generally comprise an
24 external gear on the top and bottom of the closer
25 that rotates with the opening and closing of the
26 door to which it is attached. When the external
27 gear of the door closer is rotated in the
28 appropriate direction, the door closer can be
29 reversed and can operate to open the door.

1 The power-assisted drive mechanism comprises a
2 motor, a gear box and a limit unit. The motor may
3 be an AC or a DC motor, uni-directional or bi-
4 directional. The gear box may comprise a variety
5 of gears to translate the torque of the motor to
6 the limiting unit which is attached to an external
7 gear on the door closer. For example, the gear
8 box may comprise a series of reduction gears in
9 further communication with the limit unit. The
10 limit unit provides for the positive opening of
11 the door by the power- assisted drive mechanism.
12 While there is a variety of methods in which to
13 accomplish this task, the preferred method
14 disclosed herein allows for power-assisted door
15 opening as well as unobstructed manual door
16 opening.

17

18 As the apparatus opens a swinging door, the
19 control unit senses the maximum angle θ and
20 adjusts the motor function accordingly. For
21 example, when the door opens to the maximum angle
22 θ , the control unit can eliminate all power to the
23 motor thereby allowing the limit unit to reset the
24 motor as the door comes to a closed position or in
25 the alternative the control unit can reset the
26 motor under power. In addition to detecting the
27 maximum angle of the door θ , the control unit can
28 also detect any fluctuation in current (i.e.,
29 voltage) caused by an impedance in the opening

1 door and thereby initiate a failsafe program that .
2 operates to stop the opening of the door.
3 Accordingly, should somebody step in the way of
4 the door as it is opening as the door comes in
5 contact with an obstruction such as a person, the
6 control unit will detect an increase in motor
7 power and initiate the failsafe program.

8

9 When the opening process is completed, the power
10 to the motor can be eliminated or reversed by the
11 control unit and the normal function of the door
12 closer can take over and close the door in its
13 usual fashion. Such a feature is highly desirable
14 for a number of reasons. First, such a system
15 allows for the bathroom door to open both
16 automatically and manually. Second, the apparatus
17 is easily adaptable to existing conventional door
18 closers. Third, by utilizing an existing door
19 closer time and money are saved by way of
20 installation costs and materials. Further objects
21 and advantages of the present invention will
22 become apparent by reference to the following
23 detailed description of the preferred embodiment
24 and appended drawings wherein like reference
25 numbers refer to the same feature, component, or
26 element.

1 Brief Description of the Drawings

2
3 **FIG. 1** is a perspective view of an inward swing
4 door comprising the apparatus according to the
5 present invention.

6
7 **FIG. 2** is a plan view of the actuator device
8 according to the present invention.

9
10 **FIG. 3** is a perspective view of the power-assisted
11 drive mechanism according to the present
12 invention.

13
14 **FIG. 4** is a plan view of the power-assisted drive
15 mechanism according to the present invention.

16
17 **FIG. 5** is an alternative embodiment of the power-
18 assisted drive mechanism according to the present
19 invention.

20
21 **FIG. 6** is an alternative embodiment of the power-
22 assisted drive mechanism according to the present
23 invention.

24
25 **FIG. 7** is an illustration of the proximity zones
26 according to the present invention.

27
28 Detailed Disclosure of the Invention

1 The present invention will now be described more
2 fully hereinafter with reference to the
3 accompanying drawings, in which preferred
4 embodiments in the invention are shown. This
5 invention may, however, be embodied in many
6 different forms and should not be construed as
7 limited to the embodiments set forth herein.
8 Rather, these embodiments are provided so that
9 this disclosure will be complete, and will fully
10 convey and disclose the invention to those skilled
11 on the art. Like numbers refer to like elements
12 throughout, and the prime notation indicates
13 similar elements in the alternate embodiments.

14

15 Referring now to **FIG. 1**, an apparatus according to
16 the present invention is illustrated and generally
17 designated by the reference numeral **10**.

18

19 The door opening apparatus **10** illustratively
20 includes an actuator **20** a control unit **22** and a
21 power-assisted drive mechanism **24**. The power-
22 assisted drive mechanism **24** illustratively is
23 attached to a conventional door closer **26**. The
24 conventional door closer **26** may comprise a
25 preexisting door closer or a door closer
26 integrated into the apparatus **10**. The apparatus
27 provides for the egress from a restroom without
28 requiring the manual contact with the door **28**.

29

1 The actuator **20** comprises a proximity sensor **40**,
2 audible signals (not shown), a plurality of visual
3 signals corresponding to the working status of the
4 actuator. The control unit **22** is in electronic
5 communication with the actuator **20** and the power-
6 assisted drive mechanism **26** and functions to
7 control both the actuator **20** and the power-
8 assisted drive mechanism **24**. The power-assisted
9 drive mechanism comprises a motor **60** a gear box **62**
10 and a limit unit **64**. The door closer **26** may
11 comprise an existing door closer or a door closer
12 integrated with the apparatus **10**.

13
14 It will be appreciated by those skilled in the art
15 that the control unit **22** communicates to the
16 actuator **20** and the power-assisted drive mechanism
17 **24** through wires, fiber optics, electro magnetic
18 signals, or a combination thereof. It will also
19 be appreciated by those skilled in the art that
20 the electro magnetic signals can include infra-
21 red, RF, or any other electro magnetic signal
22 known in the art.

23
24 The actuator **20** comprises at least one proximity
25 sensor **40** and a plurality of visual signals. The
26 plurality of visual signals may comprise an
27 attention signal **42**, an affirmative action signal
28 **44** and a door opening signal **46**. By way of
29 example, as a patron **I** approaches an inward

1 swinging restroom door **28** to exit the restroom,
2 the patron **I** enters a first proximity zone **80** and
3 the proximity sensor **40**, in the actuator **20**,
4 detects the presence of the patron **I**. The
5 proximity sensor **40** sends an electronic signal to
6 the control unit **22** which sends an electronic
7 signal from the control unit **22** to the actuator **20**
8 that instructs the actuator **20** to provide an alert
9 signal to the patron **I**.

10
11 For example, the alert signal to the patron **I** may
12 comprise an attention signal **42**, an audio signal
13 (not shown) or a combination thereof. The
14 attention signal **42** may comprise an illuminated
15 iconic signal **42** which illuminates steadily or
16 flashes to alert the patron **I** to the existence of
17 the actuator **20**. The attention signal **42** may
18 further comprise an audible signal.

19
20 As the patron **I** moves closer to the restroom door
21 **28** the proximity sensor **40** detects that the patron
22 **I** is within a certain zone (for example a distance
23 from the actuator up to 18 inches) and sends an
24 electronic signal to the control unit **22** which in
25 turns sends an electronic signal back to the
26 actuator **20** to indicate a change in operation
27 status, for example flashing the affirmative
28 action icon **44** on the actuator **20**. By way of
29 example, the affirmative action visual signal **44**

1 can instruct the patron **I** to wave their hand in
2 front of the actuator **20** to initiate the opening
3 of the door **28**.

4
5 In an alternative embodiment, the actuator **20**
6 constantly flashes to get the attention of the
7 patron **I**. In such an embodiment, a single
8 proximity zone **82** can be used. The actuator **20**
9 does not require a first proximity zone **80** to
10 detect the presence of the patron **I**. Instead the
11 actuator **20** flashes continuously in an "always on"
12 mode. When the patron **I** desires to exit the
13 restroom, the iconic instruction **44** is already
14 illuminated and the patron **I** need only to take the
15 affirmative action necessary to initiate the hands
16 free door opener **10**.

17
18 As the patron **I** complies with the iconic
19 instruction requiring the affirmative action, the
20 proximity sensor **40** interprets the affirmative
21 action and sends an electronic signal to the
22 control unit **22** which, first, sends a signal back
23 to the actuator to illuminate the door opening
24 signal **46** and, second, initiates the door opening
25 sequence.

26
27 To initiate the door opening sequence, the control
28 unit **22** sends a signal to the power-assisted drive
29 mechanism **24**. The power-assisted drive mechanism

1 **24** comprises a motor **60**, gear box **62**, and a limit
2 unit **64**. As will be appreciated by those skilled
3 in the art, the motor **60** may be uni-directional or
4 bi-directional AC or DC. The gear box **62** may
5 comprise a variety of gears which operate to
6 translate torque from the motor **60** to the limit
7 unit **64**. By way of example, the preferred gears
8 of the present invention comprise a series of
9 reduction gears (not shown) that allow the torque
10 of the motor **60** to be translated substantially
11 perpendicular to the plane of the motor **60**, thus
12 allowing a more compact power-assisted drive
13 mechanism **24**. The limit unit **64** receives torque
14 from the gear box **62** and functions to open the
15 restroom door **28** to a fixed angle θ . It will be
16 appreciated by those skilled in the art that the
17 limit unit **64** may operate to allow the door **28** to
18 be opened mechanically or manually.

19
20 As the motor **60** receives the signal from the
21 control unit **22** under normal conditions, it will
22 provide torque to the gear box **62** which then
23 provides torque to the limit unit **64** which is in
24 further communication with a door closer **26**.

25
26 The door closer **26** comprises an conventional door
27 closing mechanism as is known in the art. For
28 example, the door closer is mounted to the top of
29 the door **28** and further comprises a double arm

1 arrangement **68** that is attached to the header **70**
2 above the door. Such a double arm arrangement **68**
3 can operate to either push or pull the door **28**
4 open depending on the configuration of the door
5 closer**26**.

6

7 Conventional door closers generally comprise an
8 external gear **66** on the top and/or bottom of the
9 closer **26** that rotates with the opening and
10 closing of the door **28** to which it is attached.
11 The external gear **26** is generally connected to an
12 internal piston (Not shown) located in the door
13 closer **26** such that the opening of the double arm
14 arrangement **68** causes the internal piston to
15 compress an oil damping spring (not shown). Upon
16 release of the door **28**, the oil dampening spring
17 causes the door **28** to close and the dampening
18 system regulates the speed at which the door **28**
19 closes. When the external gear **66** of the door
20 closer **26** is rotated in the appropriate direction
21 (i.e., reverse), the door closer **26** operates to
22 open the door **28**.

23

24 When the door **28** opens to the preset angle θ , the
25 control unit **22** detects the angle of the door **28**
26 and sends a signal to the motor **60** to stop further
27 progress. At this point, alternative events can
28 occur. For example, all power to the motor **60** may
29 be ceased and the motor may be returned to

1 starting position as the door closer **26** functions
2 in its normal capacity to close the door **28**
3 thereby providing reverse torque on the limit unit
4 **64** which is translated back through the gear box
5 **62** to the motor **60**. In another embodiment, the
6 motor **60** may be bidirectional and as such, the
7 control unit **22** can instruct the motor **60** to
8 return to its starting position under its own
9 power.

10

11 As the door opening sequence begins, should the
12 door physically encounter any impedance (i.e.,
13 obstruction) the result will be a fluctuation in
14 current (i.e., voltage) supplied to the motor **60**.
15 The control unit **22** may be programmed to detect
16 any increase in motor voltage fluctuation and can
17 then send a signal to the motor **60** to cease
18 further operation. In the case of a uni-
19 directional motor, the cease in function signal
20 can operate simply to cut-off the electrical
21 supply to the motor **60**. In the case of a
22 bidirectional motor, the cease and function
23 instruction from the control unit **22** can operate
24 to stop the progress of the motor **60** and return it
25 to its starting position under its own power.

26

27 The control unit **22**, can be programmed to operate,
28 auxiliary electrical devices in a restroom such as
29 lights, exhaust fans, aroma therapy dispensers, or

1 other electronic apparatus that can be enjoyed by
2 an patron **I** in a restroom. The control unit **22**
3 receives electric power from an external source
4 such as an electrical box or a junction box, a
5 battery, or any other means from which electricity
6 is produced. It will all be appreciated by those
7 skilled in the art that the control unit may be
8 programmed to operate a plurality of automatic
9 door opening devices.

10